

SPECIAL TOPIC

Softswitch Based Solution to Make Network Intelligent

Abstract:

The factors, such as the network optimization or the network amelioration by fixed telecommunication network operators, the convergence of the Personal Handy-phone System (PHS) network and the Public Switched Telephone Network (PSTN), the integration of PSTN and the Third Generation Mobile Communication (3G) Network, the broadband and multimedia based communication networks, causes the requirement for fixed network's intelligentization. The Softswitch is a feasible approach to meet this kind of requirement. The solution to make the network comprehensively intelligent based on Softswitch is highly advantageous, which enriches communication services and promotes Fixed and Mobile Convergence (FMC).

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1 Background for Intelligent Network

1.1 Network Optimization and Amelioration by Fixed Network Operators

The Public Switched Telephone Network (PSTN) has been deployed for quite a long time and brought fixed network operators huge profits, but situation is changing for the time being. On one hand, operators in the new market environment need an urgent investigation on how to meet the requirement of market consumption to orient the enterprises. In addition, they need an analysis to exploit the market in order to achieve the maximum economic benefits. On the other hand, existing networks cannot satisfy users' requirement, which makes it necessary to ameliorate and optimize current networks for better market competence, customer satisfaction, telecom device operation, and more.

1.2 Convergence of PHS and PSTN

The large-scale deployment of the

Personal Handy-phone System (PHS) network adds new driving force to fixed network operator's development. However, the two local networks running simultaneously and independently bring some disadvantages.

- The two networks overlap each other for the same group of users;
- Network is still the center of service operation and management;
- Resources of network and management are not effectively integrated that it's difficult to provide package services for customers;
- The development and deployment of new services are not easy, because either network has its own Intelligent Network (IN) and own billing management platform;
- User resources are not shared sufficiently;
- Mutual compensation for advantages is obstructed by the independence between the two networks.

Consequently, it is urgently necessary to converge PHS and PSTN to make full use of advantages of the two networks for deeply digging and packing the

services, attracting more users, and improving the operation efficiency^[1-4].

1.3 Broadband and Multimedia Based Communication Networks

The communication network has been targeted for development to provide users on broadband networks with multimedia services integrating voice, data, and video. This is a direct result of the rapid increase of the broadband network bandwidth and the constant improvement in Quality of Service (QoS) and security technologies.

In order to fully utilize the existing network resources, enrich network applications, and provide better service for customers, multimedia services' operation has been naturally taken by telecom operators as their focus concern. To evaluate the competence of different operators, their multimedia services should be based on essential indexes as diversification, intelligence and collaboration. Therefore, what kind of network platform should be used, what kind of applications should be served, and whether the service is applicable and easily operational, are the crucial

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problems to be solved by operators^[5-8].

1.4 Integration of PSTN and 3G Network

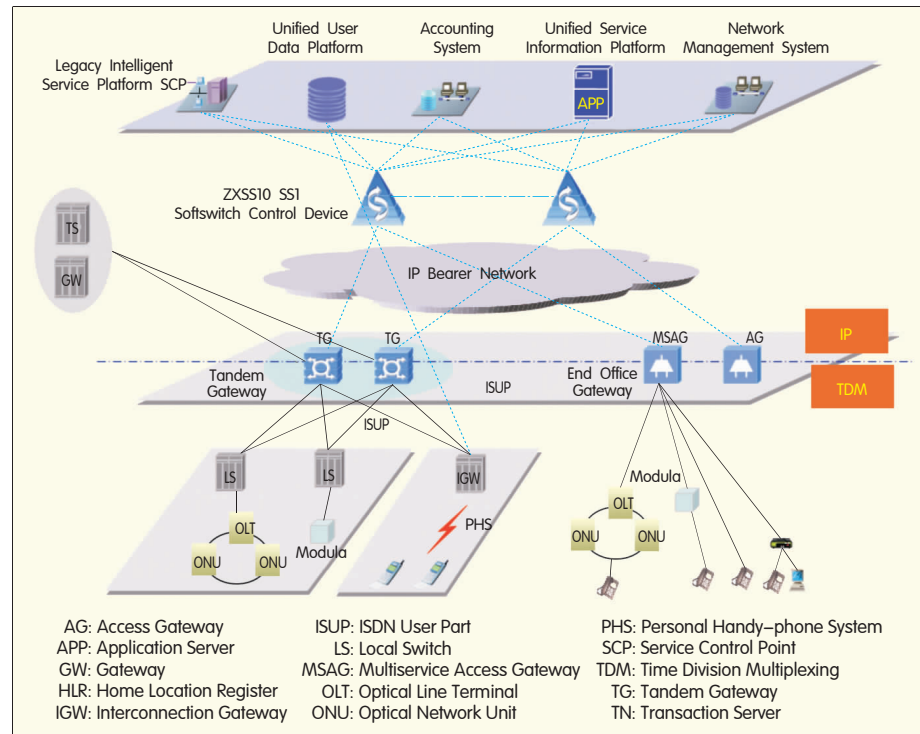
With the date to release 3G licenses getting more and more closer in China, the Next Generation Network (NGN) and the Third Generation Mobile Communication Network (3G network) have caught increasing attention of traditional operators. Except for abundant network resources, traditional carriers have rich operating experience in PSTN and broadband services after many years of operation. In order to take advantage of current PSTN and get a better position, in the upcoming 3G time, they must consider the integration of PSTN and future 3G network on the optimization of the existing networks. The issues that they should consider are listed below:

- How to use existing resources to construct 3G network and develop 3G services and market;
- How to evolve from the current network into NGN and converge NGN and 3G;
- How to build NGN and 3G service platforms on current fixed networks;
- How to transfer fixed network users to NGN and 3G networks seamlessly;
- How to make full use of the advantages of current fixed networks to improve service quality at the beginning stage of 3G.

1.5 Experimental and Commercial Deployment of Softswitch

Fixed network operators are facing increasingly fierce competition in voice and its value-added services, data, and multimedia services. Softswitch is helpful for operators to enhance the capability of service provision and raise their competence. The NGN has publicly been considered as the network evolution target by the telecom industry. After several years of the tests and trials running by operators, it has been proven that NGN technologies and related devices, with robust specifications, have tended to the mature phase. Fixed network operators will gradually transfer the present telephone networks to NGN.

The biggest advantages of NGN lie in the convenience to launch new services and the lower operation cost after network convergence. From a single



▲ Figure 1. ZTE solution for Softswitch network intelligitization.

service network to a converged network integrating multiple service networks, the construction and operation cost can be significantly reduced. By combining Internet, it is flexible to offer more Web-based multimedia services for customers. The powerful service platform of NGN simplifies the services provision to satisfy user's demand, enables any third parties to develop services on the unified service platform, and allows users to customize services on Web pages. All of these bring users a brand-new and more personalized service environment, and grant NGN an incomparable advantage of service provision.

ZTE Corporation proposed the long-term test and formal commercial operation of the construction solution to make the fixed network intelligent. This proposal is based on Softswitch and proves that it can well satisfy all demands in the ameliorative fixed network, the convergence of PHS and PSTN, or NGN construction.

2 Solution Making the Fixed Network Intelligent

The practical solution making a fixed network intelligent is shown in Figure 1.

The solution consists of the following aspects:

- (1) Using Softswitch technology to realize PSTN's optimization and amelioration.
- (2) Accessing different gateways and user terminals to IP network through flexible Softswitch access schemes.
- (3) Deploying unified Smart Home Location Register (SHLR) in the entire system to manage the circuit access domain (including PHS and PSTN) and the IP access domain simultaneously and realize network's convergence.
- (4) Centralized management of user data of the entire network.
- (5) Offering concentrative services of the entire network.

In the solution to make the network intelligent, user data of PSTN, PHS, and Softswitch are concentratively stored in SHLR. SHLR is responsible for the centralized management of all user data attributes. Furthermore, the intelligent services of traditional networks, such as PSTN, are no longer triggered by the telephone number segment, but by the subscription information, which is helpful to provide new services not available in the existing networks. (Especially the number portability service, the mixed

telephone number service, the color ring back tone service in fixed network, and more.) Core control devices of NGN interact with SHLR via standard Mobile Application Protocol (MAP) to get user's whole information. To save investment, the existing Home Location Register (HLR) of PHS can act as the SHLR of the entire network.

In addition, in the solution, the unified service platform is able to provide all users in the network with various intelligent services. For fast service provision, it is recommended to adopt the Session Initial Protocol (SIP) as the interface between the service platform and Softswitch, and implement the interface of the service platform with the Parlay interface. To protect the existing investment in IN, SS7 signaling can be used to interconnect with IN.

In the amelioration and optimization of PSTN, there are various policies respectively for different conditions of current network devices. For end offices with aged devices, they can be replaced by Access Gateway (AG), where services are directly triggered by AG to Softswitch, and connections are initialized after the service authentication in SHLR. For end offices with poor capability for intelligent services, Trunk Gateway (TG) can be introduced in the tandem scheme to meliorate the network. In which case, all originating traffics from the end office or access network are relayed to TG and then triggered to Softswitch, before the authentication in SHLR and subsequent connections.

The solution, with support for broadband user accessing, can satisfy access requirements of different broadband users with flexible and powerful access mechanisms, and serve broadband users with value-added services such as IP-based broadband multimedia.

3 Introduction of Intelligent Services

Adopting the solution that makes the network intelligent based on Softswitch, the fixed network can offer services simultaneously for users of PSTN, PHS, and broadband networks. Users can obtain any service from the entire network services as centralized number

allocation, and more. The networks are such as Wide Area Centrex (WAC), simultaneous ring, Color Ring Back Tone (CRBT), One Number Links You (ONLY), pre-pay, PHS Hotel. (The hotel supplies the user with a PHS terminal, and binds its number with a hotel fixed telephone.)

3.1 Wide Area Centrex

The WAC extends the service in a wider area based on the local Centrex, with which a group of users can span multiple local exchanges or service networks. The data of WAC are maintained in SHLR. Compared to corresponding services of IN, the WAC is more convenient to maintain and easier to implement while avoiding mass traffic bypass. Moreover, with WAC, PHS users and fixed network users compose a virtual network, enabling mutual dialing between a PHS user and a fixed network user through short number.

In addition to provision of all PSTN Centrex services, including closed user group, co-group pick-up, specified pick-up, and attendant console, the WAC can offer convenient Web-based management and self-service. For instance, the administrator may set right level for each telephone through Web page. That is, removing the limitation to local call for some office telephones, granting trunk call permission to telephones in selected offices, entitling international call right to telephones in the foreign related department, and limiting general staff to inner call. More than the right setting, for each telephone may be allocated an expense quota to effectively control the office expense. The administrator through the Web page can conveniently do all configurations. The staff can use the Web page to inquire their communication history and fees, and subscribe or cancel the service.

3.2 CRBT and ONLY

The CRBT is a service to send the caller a piece of music, advertisement, or a user's own message according to his setting, when he is called and before he answers the call. Instead of the monotonous ring back tone of "du...du..." the caller will hear the color ring back tone set by the called party in the system. The called party may predefine a personalized color ring as a

tone/music offered by the system. It also be a voice in a file recorded or downloaded in advance through IN system, or to the IN system via the network.

In ONLY service, a user has a publicly open telephone number, which is mapped to the user's other numbers. When the open number is dialed, all other numbers will ring in turn or at the same time.

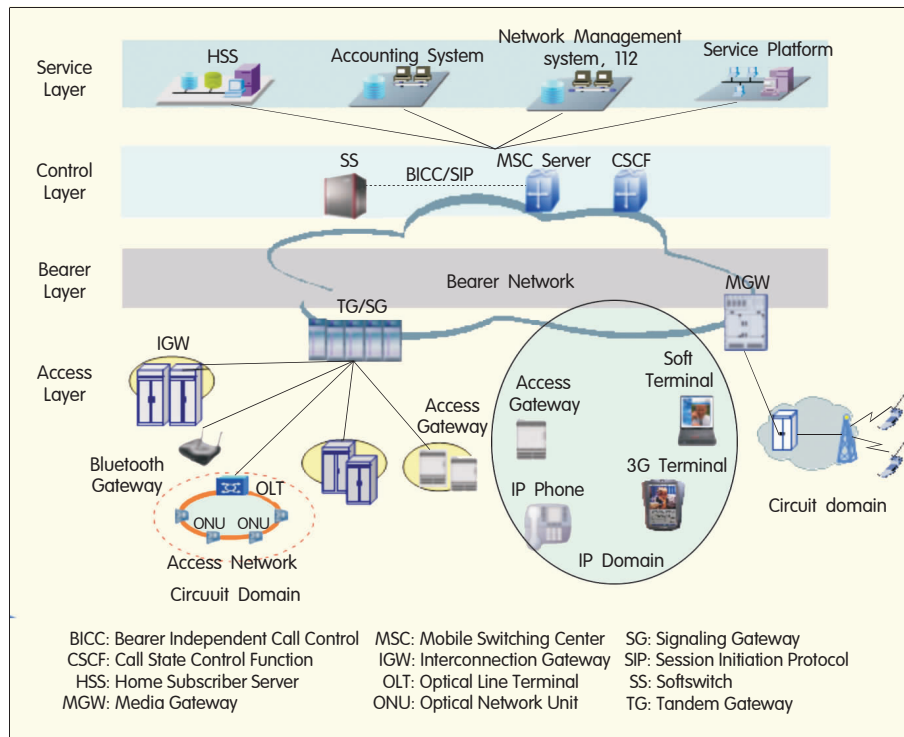
3.3 PHS Hotel

In PHS Hotel service, PHS users and fixed network users compose a virtual network, whose unified management and real-time billing are functions of the attendant console in the fixed network exchange. The PHS and its binding telephone have the same call number, that is to say, whether a user calls others via PHS or fixed telephone, the same number is shown to the called party. When the user has an incoming call, the two phones will ring simultaneously and one will stop the ring after the other answers.

The hotel's attendant console can manage all PHS and fixed network users located in the hotel rooms, including modifying rights, launching services, activating some new services, inquiring services, and more. Therefore, when a customer checks in the hotel, he can rent a PHS terminal of the public communication network and the right control of PHS can be flexibly changed in the hotel. The rent of PHS terminal will be billed in real-time mode, with the ticket immediately transferred to the hotel attendant console to help customer's check out.

3.4 Pre-pay

A user can purchase the pre-pay service in advance when establishing an account (or purchasing a charging card with fixed value). Using the user phone number, which is also the account number, user can deposit some funds into his account beforehand. Whether the call is to be admitted or rejected depends on the account value, when the call is established. In a call, the communication fee is subtracted from the user account by the real-time billing. When the remaining value is insufficient, the user will be informed by a recorded voice



▲ Figure 2. Convergence architecture of fixed network and 3G.

message.

In a traditional way, the caller needs to dial the access code of the pre-pay service. In other way, the access code will be automatically added to the beginning of the dialed number after the originating exchange identifies the caller is a pre-pay user. However, with SHLR, the originating exchange can easily trigger the per-pay service.

3.5 Centralized Number Allocation

The solution for intelligent network support centralized number allocation services, such as mixed telephone number service and number portability service.

Mixed telephone number allocation aims to comprehensively plan the number resource of the local network including the fixed network and PHS. The number used to dial has no direct relationship with the service network or office location. Different numbers with the same number initial could be freely used in both the PHS and the fixed network.

Number portability service in the intelligent fixed network is similar to the "universal personal number" services of the current network, but their implementation methods are greatly

different. The Service Control Point (SCP), which is very complex and results in traffic bypass implement the latter. On the contrary, the real number portability in the local network can be achieved through SHLR, avoiding traffic bypass effectively.

4 Convergence of the Fixed and Mobile Networks

The solution for intelligent fixed network grants the fixed network an open architecture of the mobile network (shown in Figure 2). The intelligent fixed network and the 3G network have the same core network. They have the same data bearer network; and furthermore, the elements of the intelligent fixed network can be smoothly upgraded to 3G elements to realize Fixed and Mobile Convergence (FMC).

The SHLR in the intelligent fixed network is upgradeable to be Home Subscriber Server (HSS), which stores all the user information, becomes the center of the network management and service implementation, and serves the fixed and upcoming 3G networks. The HSS, evolved from SHLR can offer two interfaces of Diameter and MAP, not only

to be compatible to the old network but also to be prepared for 3G networks.

After the convergence of the intelligent fixed and 3G networks, the old fixed network turns into the fixed part of 3G networks. The Softswitch, as the core control device of the fixed part in mobile 3G, employs SIP-I/SIP-T protocols to interact with control devices such as Mobile Switching Center (MSC) server and Call State Control Function (CSCF) server, achieving the communication of the entire network.

The Softswitch can support data and video multimedia services. The Softswitch device of ZTE Corporation, the ZXSS10, has already integrated functions of element entities of IP Multimedia Subsystem (IMS) domain such as CSCF. It can be transited to IMS by just adding or modifying the relevant interfaces and modules.

In the convergence network, TG not only plays a role of the intelligent fixed network, but also interconnects the media plane between the fixed and mobile networks. At the condition of abundant TG devices, some can be updated to have Media Gateway (MGW) functions to save the investment in 3G network construction.

In the intelligent solution, IP access domain may be evolved into 3G IMS domain through smooth upgrade, replacing the traditional voice service to provide enhanced voice services and offering real-time multimedia services such as broadband voice or video.

5 Conclusions

The solution for intelligent fixed network of ZTE Corporation can provide:

- Centralized user data platform;
- Centralized service provision platform;
- Unified call control platform;
- Unified bearer transport platform;
- Diverse access modes.

The advantages of the ZTE solution are concluded as follows:

- Fully utilize the current network resources and protect the investment.
- It is not necessary to change the SHLR device, and HLR in the present PHS network can be fully reused, which reduces the investment.
- Similarly, to the structure of 3G

network, SHLR storing all user attribute information is connected through MAP. In addition, the Softswitch has the function of Visit Location Register (VLR) that synchronizes the user attribute information automatically with that of SHLR and simplifies the operation and maintenance.

- The centralized management of all network user data permits users to move in the entire network and offers centralized number allocation services, such as personalized number and number portability, mobile office, and so forth.

- The PHS, PSTN and Softswitch are really converged by the open network architecture and centralized user data management in SHLR.

- Services of the total network are provided unitedly.

- Users have diverse access methods, including broadband and narrowband domain.

- The centralized service platform is used to provide all users in the network

with various value-added services and IP-based multimedia services, which accords with the operator's development trend.

- The PSTN can be smoothly upgraded to NGN.

- It is able to be merged with 3G, and it can compose the basis of 3G network construction for operators.

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Electcoms Puts ZTE GoTa Network into Commercial Use

Roundup

Electcoms, the largest professional trunking network operator in Malaysia, has launched a network based on ZTE's Global Open Trunking Architecture (GoTa). The launch, in Kuala Lumpur, Malaysia, was attended by Dato' Seri Dr. Lim Keng Yaik, Minister of Energy, Water & Communications, Malaysia, and Mr. Cheng Yonghua, China's ambassador to Malaysia.

The Electcoms GoTa network is being built in three phases. The Phase 1 network covering the Kuala Lumpur region has been completed, and is expected to reach a subscriber base of about 50 000 in two to three years. Phase 2 and Phase 3 of the network will expand the Phase 1 system to cover the whole of Malaysia.

Electcoms entered the Malaysian analogue trunking communications market in 1989 and now has 75% market share, with services principally covering the economically developed West Peninsula area of Malaysia. The company began offering digital trunking in 1999. Electcoms reviewed a wide range of vendors for the current project and selected ZTE's CDMA-based GoTa as a strategic technology for the future development of its trunking networks based on the system's feature-rich services and advanced digital

technologies.

"The successful deployment of Phase 1 of this GoTa network takes the strategic partnership between ZTE and Electcoms to a new stage. ZTE will cooperate with Electcoms to drive the continuing growth of Malaysia's telecommunication business," said Mr. Zheng Bang, chief representative of ZTE Malaysia.

GoTa, the world's first CDMA-based digital trunking system, was independently developed by ZTE, and was the first Chinese telecoms technology to be licensed to other global telecoms equipment vendors.

GoTa systems have been deployed in over 10 countries including Russia, Norway, Mongolia, Vietnam and Haiti. It is the only China-developed digital trunking system that has found a wide range of commercial applications in the global market.

In China, ZTE has worked with China Tietong and China Satcom to build GoTa commercial networks in cities of Shenyang and Changchun respectively, and to trial China's first city emergency response project in Weifang. In October 2005, China Satcom adopted the GoTa system to deliver dispatch services to the 10th National Games of China. (ZTE)